(6) The skin-friction of even surfaces is practically independent of the material composing them.

(7) The resistance of symmetrical spindles and wedges of easiest shape, as of simple planes gliding at the most efficient angle of flight, is roughly, one-half friction, one-half unbalanced pressure.

## HYTHERS AND THE COMPARISON OF CLIMATES.

Under the above title we had the pleasure of publishing in the MONTHLY WEATHER REVIEW in June, 1907, page 267, a letter from Mr. W. F. Tyler of Shanghai that had been a long time delayed. At that time we had not read Mr. Tyler's recent memoir—"The psycho-physic aspect of climate. London, 1907,"[1] but were desirous to make known his exprest hope (MONTHLY WEATHER REVIEW, June, 1907, XXXV, p. 268) that someone would investigate the limiting conditions of temperature and humidity under which animal life can exist. By experimenting upon animals in confinement such a research can be pushed to the determination of the death point. So far as human life is concerned there are many occupations in which life continues under observable extremes of heat and cold, dryness and moisture, calm and winds. Those who will keep records of their sensations when employed in iron or steel works, or in gas works, and especially in the well-regulated furnace rooms of ocean steamships,—those on the other hand who labor in the sunshine and pure air of the Imperial Valley and Salton Sea or the Sahara Desert, and those who as aeronauts or mountaineers penetrate cold clouds, should be able to add considerably to the data that Mr. Tyler is collecting for study.

The Editor recalls vividly his own experience in going from the deck of a steamer down into the furnace room with the stokers; the temperatures then determined by him with the protected sling psychrometer were about as given by (1) and (2) in the table. Another experience in the hot, dry air of a room heated by a Russian furnace gave observations (3) and (4). In the warm dry air of sunny winter quarters in Washington, such readings as (5) and (6) were obtained.

Perhaps the most delightful conditions were those of (7), prevailing thru the night in a strong southeast trade wind on the summit of Telegraph Hill on the Island of Ascension in February, 1890, where we could sleep without protection in a wind whose temperature scarcely varied from those of (7).

TABLE 1.—*Indoor and outdoor humidities observed by Prof. C. Abbe.*

| Locality. | Dry bulb. | Wet bulb. | Dew point. | Relative humidity. |
|---|---|---|---|---|
| | °F. | °F. | °F | *Per cent.* |
| Atlantic steamer: | | | | |
| (1) In the free air | 91 | 85 | 83 | 78 |
| (2) In the furnace room | 120 | 91 | 83 | 33 |
| Russia: | | | | |
| (3) In the free air | 0 | 2 | 20 | 33 |
| (4) Furnace-heated room | 120 | 65 | 20 | 1 |
| Washington, D. C.: | | | | |
| (5) In the free air | 33 | 30 | 25 | 70 |
| (6) Warm, sunny room | 80 | 54 | 26 | 12 |
| Island of Ascension: | | | | |
| (7) In the free air | 66 | 65 | 64 | 95 |

Most of these seven different conditions are agreeable to the writer with a proper adjustment of the wind velocity, but the sensations produced are widely various: thus (7) is restful and relaxative; (1) is perfectly indolent; (2), (4), and (6) produce a restless, uneasy, creepy, cold sensation as the skin becomes dry and harsh, one must drink much water and can scarcely do enough muscular exercise to counteract the dryness and keep the skin moist by a rapid circulation of the blood; (3) and (5) stimulate to exhilaration and to excellent intellectual work.

The following conditions—

(8) Free air 55°, wet 50°, DP 45°, RH 73 per cent,

(9) Free air 60°, wet 52°, DP 45°, RH 68 per cent,

are admirable for outdoor exercise and the attendant intellectual stimulus, when the rapid circulation of the blood enables the brain to work rapidly, easily, smoothly, and with precision. One who works steadily for several hours in quiet until his food supply becomes low, the blood fills with effete matter faster than the purifying organs can eliminate it, and the circulation becomes feeble—will usually find himself growing apparently colder, and will require the temperature of the room to be raised from 50° to 60° and perhaps to 70° or 80°, *i. e.*, to temperatures that would have seemed very uncomfortable at the beginning of his work.

These experiences are worthy of record and study, they will on the one hand elucidate the needs of our human physiology and on the other hand help us to more clearly define the relation between natural climates and the evolution of the peculiarities of the races of mankind.

The great variety of climates offered by the stations of our Weather Bureau and the frequent interchanges of observers suggests to us that each make a list of the stations at which he has lived, the length of time in years and months and the impressions produced on him as to the influence of the respective seasons of the local climates.

This information may possible be condensed into tabular form and a few general conclusions be drawn from the experiences of so many men. Mr. Tyler reminds us that for uniformity's sake the influence of the climate should be recorded on a scale of 0 to 10 where 10 will represent the worst day, hot, damp, close, muggy, enervating, that the observer remembers to have experienced at any time; and 0 will represent an ideal summer day, warm, brisk, bright and bracing. In the first case no diminution of clothing makes the free air less uncomfortable and in the second case no increase is needed in order to make it more comfortable. Mr. Tyler recommends that the estimates relate especially to the sensation at the noon or mid-day hours, unless indeed the observer wishes to make a very complete record and determe the diurnal changes.

This is a subject that we earnestly commend to the attention of the experts in physiology and psychology who are considering appropriate researches in several of our best universities.—*C. A.*

## THE RELATIVE HUMIDITY OF OUR HOUSES IN WINTER.

In connection with the above note on Hythers and Climates, it may be of interest to many readers to have an account of certain related observations carried out by Prof. R. DeC. Ward in Cambridge, Mass., eight or nine years ago.[1] His account and comments are given in slightly changed form here.

*The observations.*—The observations were made in the study of the observer by means of H. J. Green's Marvin sling-psychrometer, and extended over three weeks of November, 1899, from the 3d to the 23d. The hours of observation varied, but the number was from two to five daily. Each observation comprised a record of the readings of the wet and dry-bulb thermometers, the condition of the out-of-doors weather, the amount of ventilation by means of the window, the temperature of the air coming from the furnace, and the stage of the water in an evaporating pan placed inside the register of the room.

The study in which the observations were made was heated by hot air from an ordinary hot-air furnace provided with the usual small evaporating pan. Inside the delivering register stood a vessel holding a little more than half a liter of water.

[1] See Monthly Weather Review of May, 1907, p. 227, column 2.

[1] The results were first published in the Boston Medical and Surgical Journal, March 1, 1900; later revised and printed in The Journal of School Geography, I, 1902, pp. 310-317.